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Optomotor reaction of milkfish larvae and juveniles

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Milkfish, *Chanos chanos* (Forsskal), fry picked at random from rearing aquaria were subjected to optomotor reaction (OMR) tests. The development of the OMR through the metamorphosis of milkfish larvae and juvenile during the first 30 days from capture on the shore was determined.

Milkfish larvae showed strong rheotactic responses at capture and their OMR, which is the most basic reaction by vision closely related to other visual behavior of fishes, may be already developed. However, responses to the moving stripes were somewhat weak. When the drum was rotated in a certain direction, some of the larvae moved along the wall of the beaker or turned their bodies slowly in the same direction, which was scored as a positive reaction (Nd). Sometimes, one or two larvae moved counterdirection and this was scored as a negative response (Nc). There was no direction preference exhibited ($t = 1.668, df = 79, 0.1 \; P < 0.05$).

The result of the paired t-test of the responses showed that the larvae responded more strongly to the bold stripes than to the fine ones during fast drum rotation, but there was no such tendency during slow drum rotation (Table 1). This behavior of the larvae lasted for almost a week. The over-all results of the OMR tests are illustrated in Figure 1, for larvae just captured up to juveniles (30 days later). It is clear that OMR undergoes a big change during the transition from larva to juvenile.

Milkfish larvae upon capture have densely pigmented eyes, transparent bodies and no pelvic fins. They form a school or two in the aquaria, or similar containers, but the strong synchronized movement typical of a school is absent. On the fifth day after capture, the pelvic fins were observed in some larvae and the peritoneum became silvery in pigmentation. On the sixth day, pelvic fins were observed in all specimens. On the eighth day, the body sides also became silvery, probably due to the deposit of guanine and hypoxanthine. The finfold gradually retreated and completely disappeared on the 15th day. It seems that the transformation of the larva with the unfish-like appearance into the juvenile with the adult-like form occurs during this period, that is, within 10 days from the development of the pelvic fins until the disappearance of the finfold. The authors are tempted to name this period as the metamorphic stage following Ahlstrom and Counts (1958) and Gehringer (1959). The appearance of the scale was recognized on the 28th day after capture.

During the period from the appearance of the silvery pigment on the body surface to two days before the end of the metamorphic stage, the fish moved randomly in the beaker during the OMR tests and no definite response could be observed. On the 14th day, a definite positive response to the bold stripes was observed. Thereafter, all juveniles moved with the same speed and in the same direction as the moving bold stripes, but did not respond to the fine stripes.

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Table 1. A comparison of the amplitude of response to bold and fine stripes with velocity of rotation.

Fast rotation (105°/s)			Slow rotation (48°/s)		
Bold	Fine	Difference	Bold	Fine	Difference
2.0	2.2	-0.2	1.2	2.6	-1.4
3.8	2.8	1.0	2.2.	2.0	0.2
4.0	3.8	0.2	3.2	1.8	1.0
4.8	0.4	4.4	2.6	1.8	0.8
2.6	2.8	-0.2	1.8	1.8	0
2.6	-0.2	2.8	1.6	1.6	0
2.8	0.8	2.0	-0.2	1.2	-1.4
4.4	2.2	2.2	2.8	3.0	-0.2
	Average	1.55		Average	-0.075
	SE ±	0.560		SE ±	0.316
95% confidence limit	±	1.339	50% confidence limit	±	0.225

The juvenile milkfish showed very quick synchronized movement and strong schooling in the rearing aquaria. When juveniles of the same size were used in the OMR tests, the response was almost perfect and the calculated amplitude of response became nearly five. But when there was a large variation in size, the smallest juvenile always moved randomly and disturbed the positive response of the others; calculated amplitude of response became lower as a result. The disturbance was serious when the drum was rotated slowly. The probable tendency of the change of the amplitude of OMR with growth is shown with the bold line in Figure 1, taking the disturbance into account. The optomotor reaction of milkfish larvae is rather weak, but that of the juveniles is strong and almost perfect.

According to Liao, et al. (in press), the two-day old milkfish reared from eggs showed rheotaxis at daytime but simply drifted at nighttime. Conspicuous feeding behavior was also observed. Thus, it appears that the development of the optomotor reaction in milkfish larvae starts at this early stage, but from the present study it could be concluded that the optomotor reaction of milkfish is not fully developed before the juvenile stage.

LITERATURE CITED

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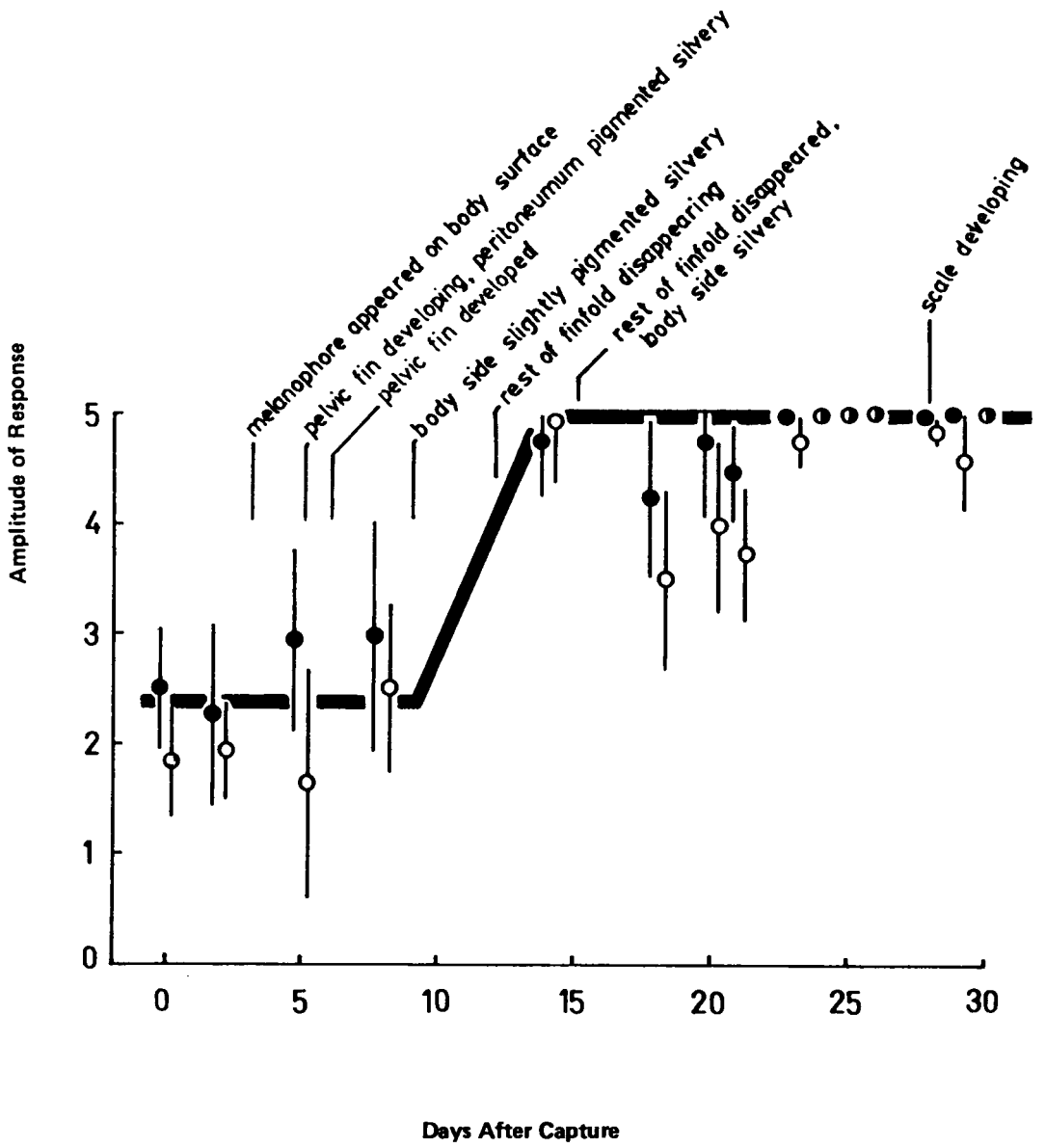

Fig. 1. The optomotor reaction (OMR) of milkfish fry and juveniles. Closed circles – fast rotation; open circles – slow rotation. The vertical bars across the circle show the confidence limits at 95% level. The bold lines show the probable tendency of changes in OMR with growth and metamorphosis.